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RESUMPTION OF EGG-LAYING BY HIBERNATED COTTON BOLL WEEVILS (*ANTHONOMUS GRANDIS* BOH.)

By EDGAR F. GROSSMAN[1]

The following discussion is offered in view of the widespread belief concerning boll weevil egg-laying to the effect that "It is evident that while leaves will sustain life, certain nutritive elements found only in squares are essential in the production of eggs: * * * it seems peculiar that upon a purely leaf diet eggs are not developed, but all observations made indicate that this is the case."[2]

The above quotation indicates the conclusions reached by Dr. Hinds after completing experiments carried on during 1902, 1903, and 1904. The experiments, at first dealing with the length of time weevils would feed solely on leaves, led to observations indicating that no eggs were laid until the boll weevil had been fed on cotton squares for a number of days. Tests showed that weevils, feeding on leaves for a period of three weeks and then changed to a cotton square diet, would begin to lay eggs in four days. Later tests showed that after feeding on leaves for six weeks oviposition began from three to five days after squares were substituted for the leaves.

The present writer, however, noticed that the first small squares to appear in a boll weevil infested cotton field contained weevil eggs. A careful examination showed that there were no other squares in the field capable of supplying a three to five day square diet for the weevils. The supposition reached, therefore, was that the weevils, after sufficient leaf-feeding, would lay eggs in the squares as soon as they became available.

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[1]Contribution from the Department of Cotton Investigations, Florida Agricultural Experiment Station.

[2]Hinds, W. E. Bulletin 51, pp. 112-113, Bureau of Entomology, U. S. D. A., 1905.

In order to investigate this possibility, the writer inaugurated a series of experiments to determine: (A) whether or not chemical analysis would reveal a greater or lesser concentration of ether extracts, nitrogen and carbohydrates in the squares than in the leaves; (B) whether or not egg-laying depended chiefly on concentration of diet; (C) whether or not there were certain nutritive elements found in the cotton squares which were not in cotton leaves; and (D) whether or not the possible presence of vitamin E was a contributing factor towards egg-laying.

Chemical analyses of various parts of plants show that generally there is an increasing gradient of total nitrogen and a decreasing gradient of polysaccharides and sucrose towards the portions of the plant showing the most active vegetative growth.[1] [2] Since there was a marked difference in the activity of the weevil in oviposition after feeding on lower and terminal leaves, respectively, and comparative little difference in activity after feeding on terminal leaves or cotton squares, the squares and terminal leaves were analyzed for a comparison of ether extracts, total nitrogen and carbohydrate content.

TABLE I. A COMPARISON OF THE PERCENTAGES OF ETHER EXTRACTS, REDUCING SUBSTANCES, TOTAL SUGAR, SOL. STARCHES AND DEXTRINS, TRUE STARCH AND HEMICELLULOSE, TOTAL HYDROLIZED CARBOHYDRATES AND TOTAL NITROGEN IN TERMINAL LEAVES AND SQUARES OF YOUNG COTTON PLANTS.

	Ether Extract	Reducing Substances	Total Sugars	Sol. Starches and Dextrins	True Starch	Hemicellulose	Total Hydrolized Carbohydrates	Total Nitrogen
	%	%	%	%	%	%	%	%
Leaves	5.50	2.050	2.983	1.900	3.516	6.266	14.665	4.66
Squares	3.03	1.483	2.266	1.800	3.466	5.733	13.265	3.60

All determinations made on dry weight basis.

All carbohydrates given in terms of glucose.

[1]Kraus, E. J., and H. R. Kraybill. Bulletin 149, Oregon Agr. College Experiment Station. 1918.

[2]Graber, L. F., N. T. Nelson, W. A. Leukel and W. B. Albert. Research Bulletin 80. Agr. Experiment Station, University of Wisconsin. 1927.

A chemical analysis (obtained through the courtesy of Dr. W. A. Leukel, Agronomy Department, Florida Agricultural Experiment Station) of the terminal leaves and cotton squares is given in Table I. As indicated in later experiments, no great significance can be attached to the chemical differences, as shown in Table I, between the terminal cotton leaves and cotton squares, with regard to egg-laying.

For determining whether or not there were certain nutritive elements found in the cotton squares which were not in cotton leaves, weevils emerging from hibernation were used. Such weevils were considered satisfactory since they were known not to have eaten cotton squares or leaves for a period of four to five months.

The use of weevils as an index for determining the comparative effectiveness of cotton leaves and squares for egg-laying, necessitated the following experiments: (a) weevils fed squares to determine the average number of days required for oviposition; (b) weevils fed lower (fully developed) leaves for a varying number of days after which squares were substituted for the leaves; and (c) weevils fed terminal (growing) leaves for a varying number of days before squares were substituted.

Immediately on emerging from hibernation one set of weevils was placed, along with fresh cotton squares, in lantern jars which were kept in a constant temperature chamber where 82° F. was maintained throughout all the following tests. A second set of weevils was placed in jars with fully grown cotton leaves picked from the lower part of the plant. A third set of weevils was placed in jars with young and tender growing leaves picked from the terminal portion of the branches.

The first set of weevils (see Table II), those fed immediately on cotton squares, consisted of 181 individuals assembled in 27 groups of varying numbers, 2 to 15, males and females. Daily observations were made in order to determine the first evidence of oviposition. The shortest period of feeding occurring in any one group before eggs were laid was 4 days; the longest, 8 days. The average length of time required for the first egg to be laid in any one group was about 6 days.

The second set consisted of weevils which, on emerging from hibernation, were fed on fully grown cotton leaves collected from the lower branches of the plant. One hundred and ninety-six weevils were assembled in 12 groups, with from 6 to 20

weevils, males and females, per group. Though weevils in these groups were fed the above specified leaves, 4, 5, 6, 10, 15 and 18 days, respectively, before being changed to a square diet, there is little evidence of a reduced length of time for oviposition. The shortest period of square diet, following varying lengths of presquare leaf diet before egg-laying began, was, as in the case of the first set of weevils, 4 days. The longest period was 7 days and the average length of time in any one group was about 5 days, a day shorter than when there was no presquare diet offered the weevils.

The third set of weevils, taken as they emerged from hibernation, was fed on young and tender leaves picked from the terminal ends of the cotton branches. There were 197 weevils in this set, assembled into 53 groups, of from 2 to 10 weevils, males and females, per group. After feeding on the terminal leaves for 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 18, 19, 21, 23, and 24 days, respectively, the weevils were given a square diet and the first oviposition was noted. The shortest period of square diet, prior to oviposition, was less than 24 hours, and the longest period was 8 days. The average length of time required was about 3½ days, 2½ days shorter than when there was no presquare diet, and 1½ days shorter than when lower leaves were given the weevils as a presquare diet.

In the third set there appears to be a general tendency for a decreasing of the time required for square feeding before oviposition. This condition, in addition to the appreciable reduction in the average time required, would indicate that egg-laying depended chiefly on concentration of diet. One would also be led to believe that there were not certain nutritive elements found in the cotton squares which were not in cotton leaves. There is a marked difference, however, between leaves gathered from those portions of the plant showing the most and least active vegetative growth. Fully grown leaves appear to meet the requirements for life, but not those for egg-laying, while growing leaves appear not only to sustain life but also to stimulate egg-laying by contributing the necessary food concentration.

In view of the fact that in two instances eggs were laid within 24 hours following a leaf diet, it can be assumed that if a vitamin is in question it is present in the terminal leaves as well as in the squares and consequently would be of little interest in this particular connection.

TABLE II. A COMPARISON OF BOLL WEEVIL OVIPOSITION AFTER FEEDING ON: (A) A COTTON SQUARE DIET; (B) LOWER LEAF DIET LATER CHANGED TO A SQUARE DIET; AND (C) TERMINAL LEAF DLET LATER CHANGED TO A SQUARE DIET.

Weevils Fed on Cotton Squares Only		Weevils Fed on Lower Cotton Leaves and Then Fed on Squares			Weevils Fed on Terminal Cotton Leaves and Then Fed on Squares		
Weevil Number	Preoviposition Days	Weevil Number	No. Days Fed on Leaves Only	No. Preoviposition Days on Squares	Weevil Number	No. Days Fed on Leaves Only	No. Preoviposition Days on Squares
					378-379	4	6
					380-388	4	0[c]
					389-390	5	6
					391-394	5	4
					395-404	5	5
					405-413	5	3
					414-415	5	4
1-10[a]	4[b]	182-194	4	6	416-425	5	4
11-15	4	195-211	5	5	426-435	5	2
16-26	7	212-227	5	7	436-441	5	4
27-32	5	228-247	5	5	442-451	6	4
33-35	8	248-267	5	5	452-454	6	3
36-37	6	268-279	6	5	455-456	7	6
38-39	7	280-291	6	4	457-458	7	3
40-41	4	292-311	10	4	459-460	7	3
42-43	4	312-331	10	5	461-462	7	4
44-45	7	332-351	15	5	463-464	7	4
46-47	4	352-372	15	6	465-466	8	2
48-49	4	372-377	18	5	467-468	8	6
50-51	7				469-471	9	3
52-53	5				472-473	9	3
54-55	5				474-478	9	5
56-57	7				479-481	9	8
58-59	7				482-483	9	4
60-61	7				484-485	9	4
62-71	6				486-471	10	2
72-81	7				472-478	10	4
82-91	7				479-480	10	3
92-106	7				481-484	10	5
107-121	6				485-489	10	2
122-136	5				490-495	10	6
137-151	6				496-499	11	5
152-166	5				500-509	11	1
167-181	5				510-511	14	1
					512-518	14	3
					519-521	15	7
					522-527	15	3
					528-530	15	2
					531-534	15	0[c]
					535-536	15	3
					537-538	15	3
					539-540	15	3
					541-546	15	5
					547-552	15	4
					553-554	18	1
					555-556	18	1
					557-558	18	1
					559-560	18	3
					561-565	19	1
					566-567	21	1
					568-570	21	3
					571-572	23	5
					573-574	24	5

a. All weevils were placed in the jars in groups, males and females.
b. The first egg laid was recorded.
c. Laid egg within 24 hours.

The question of boll weevil egg-laying is rather important economically, since early season poisoning is directed against boll weevils emerging from hibernation. If it is believed that the weevils must first feed on squares before they can lay eggs, poisoning may be delayed long enough for the hibernated weevil to establish itself through the means of an unmolested first generation hatched weevil. If, however, it is realized that the weevils, feeding in the cotton buds prior to the appearance of squares, are prepared to lay eggs as soon as the squares become available, early poisoning would be rigorously followed.

PROF. SILVESTRI VISITS FLORIDA

Dr. Filippo Silvestri of Portici, Italy, visited Florida during the last week in September. He found the heavy infestations of entomogenous fungi parasitizing aleurodids and scale insects very interesting. Dr. Silvestri, who has visited all the important citrus growing regions of the world, stated that never before had he found entomogenous fungi so abundant nor had he ever seen such large citrus trees.

DR. BALL LEAVES FLORIDA

Dr. E. D. Ball, who has had charge of the State Plant Board laboratory at Sanford for the study of the Celery Leaf-tyer, is leaving for Arizona where he becomes Dean of the College of Agriculture and Director of the Experiment Station. It is with deep regret that his coworkers in Florida and the Florida Entomological Society, of which he is the president, views the departure of Dr. Ball. Dr. Ball came to Florida in August, 1925.

An especially interesting feature of Dr. Ball's work with the Celery Leaf-tyer at Sanford has been his studies of the relation between severe outbreaks of this insect and weather conditions during the winter months. Temperature, acting directly upon the insect and upon its chief parasite was found to be the chief factor. These results will be published shortly. Dr. Ball's work has also shown the value of birds as controllers of this insect. He has developed the use of pyrethrum instead of arsenicals in the control of this insect.

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THE VELVET BEAN CATERPILLAR, A PEANUT PEST IN THE EVERGLADES

It has long been known that the velvet bean caterpillar (*Anticarsia gemmatilis*) would eat peanuts, but the only circumstance under which this crop has been attacked under field conditions was when it was planted adjacent to a velvet bean field. If the caterpillars completely defoliated the velvet beans they would sometimes crawl over onto the peanuts and complete their growth on that plant, but the moths were never observed to lay eggs on peanuts nor were the first instars of the caterpillars ever observed on that plant. This condition has held during the present season about Gainesville and in all other sections of the state where observations were made except in the Everglades. In the Everglades, however, some plantations, one a large one comprising 150 acres, were severely attacked by this insect. During July all instars of larvae were found abundantly on peanuts as were also eggs. The moths were observed laying eggs on peanuts. With the exception of a few very small patches of velvet beans, the hitherto known host plants of this insect (*Cannavalia*, the native host plant, kudzu, and Soya Beans) seem to be entirely absent from the Everglades. The moths are powerful fliers and as they fly over the Everglades, in the absence of their preferred host plants, they are forced to lay their eggs on the only available plant. This is probably the reason that this insect has developed as a pest of peanuts in the Everglades but not in other parts of the state where velvet beans are available.

As hitherto recorded for the northern part of the state, these caterpillars are unusually free of parasites, from only about one

per cent of the pupae collected in the field did a parasite, a tachinid fly, emerge. On the other hand, they are very subject to attack by predators, the carabid beetle *Calosoma sayi* was especially abundant in the Everglades.

AN OUTBREAK OF THE SEMI-TROPICAL ARMY WORM

The past summer has witnessed an unusual outbreak of the Semi-tropical Army Worm (*Xylomyges eridania* Cramer). They were first noticed early in July in the Everglades, where they practically defoliated the Water Hemp (*Acnida cannabina* L., *Ameranthaceae*), and were found on many grasses, cowpeas, etc. By the latter part of the month they had appeared over the entire peninsula at least as far north as Gainesville, where they attacked sweet potatoes, many grasses and especially Coffeeweed (*Glottidium* vesicarium (Jacq.) Desv.). Some citrus growers made the mistake of cutting their cover crop of cowpeas when attacked by this insect and drove these caterpillars to the young trees whose leaves they ate.

The caterpillars have been highly parasitized. From a hundred pupae Mr. W. L. Thompson at Lake Alfred hatched out 66 moths, 26 tachinid flies and 8 ichneumon flies. From young larvae at Gainesville Mr. H. E. Bratley bred large numbers of a small hymenopteron. Sometimes the percentage of caterpillars killed by the latter was as high as 90. *Calosoma sayi* was very active in destroying the pupae in the Everglades.

The last important outbreak of these insects in Florida occurred during the summer of 1918 when they attacked the castor beans which were being raised to furnish oil for the army airplanes. The poisoned bran bait has given effective control of the caterpillars.

EFFECT OF THE HURRICANE ON THE ABUNDANCE OF SOME INSECTS

It has often been observed that heavy rains, especially when accompanied by high winds, are very destructive of insect life. In this connection some observations on the effects of the rather mild tropical hurricane that passed across central Florida from August 7th to 10th are offered.

At Lake Alfred Mr. W. L. Thompson has been keeping weekly records of the numbers of predators per 10,000 individuals of Aphis spiraecola. Lake Alfred was near the center of the storm. However, the wind was not especially violent there, little damage was done to trees or buildings, but five inches of rain fell in two days. The following table gives the number of aphid predators counted before and after the storm. In this table the following predators are recorded in order. Blood-red Ladybeetle (*Cycloneda sanguinea immaculata* (Fab.)), larvae (l.) and adults (a.); Convergent Ladybeetle (*Hippodamia convergens* Guer.) larvae and adults; the larvae of *Baccha clavata* Fab.; larvae of *Baccha lugens;* aphis lions (larvae of *Hemerobius* sp.).

Aug.	Aphids	C. l.	sang. a.	H. l.	conv. a.	B.clav.	B. lug.	Hem.	Total	Per 10000 Aphs.
3-6	10,000	5	3	4	2	58	9	2	83	83
10-11	2,000	0	3	0	0	0	0	0	3	15
20-23	5,000	0	4	0	0	9	13	4	30	60

It is thus seen that there was a great and sudden drop in numbers after the storm. The diminution in numbers was really much greater than this table would indicate, as much more territory was covered in searching for the 2,000 aphids (all that could be found) on August 10th-11th than for the 10,000 counted before the storm. The table indicates that the more delicate predators, larvae of syrphus flies, suffered more severely than the aphids, which themselves suffered very marked destruction.

That such a storm may clean a colony of parasitic fungi and thus improve the sanitary conditions in the aphid colony is shown by Mr. Thompson's observatioins on *Empusa Fresenii* Now. Among the 10,000 aphids counted on August 3-6 were the corpses of 500 which had been killed by this disease. After the storm and up until August 30, not a single one was found.

Other insects whose numbers were markedly decreased by the storm were the Six-spotted Mite (*Tetranychus sexmaculatus* Riley) and the Rust Mite (*Phyllocoptes oleivorus* (Ash.)).

At Gainesville, over 100 miles to the north of the center of the storm, where, however, over 5½ inches of rain fell in two days, it was noticed that nearly all of the butterflies were destroyed. Those that were noticed after the storm were evidently all freshly emerged specimens.

THREE RECENT BOOKS OF INTEREST TO ENTOMOLOGISTS

Two interesting and valuable books (from the Macmillan Company, New York) have appeared during the summer. "The Biology of Insects" by George H. Carpenter, Keeper of the Manchester (England) Museum. The subject is accurately described by the title. It is distinctly different from the general run of books on insects. Classification of insects is restricted to a single short chapter and anatomy is treated only when necessary to explain function. The author states the aim of the book as an attempt "to demonstrate insects as living organisms." A list of the nineteen chapter headings will give the reader a good idea of the ground covered: Introduction, structure and function; Feeding and Breathing, living cells and protoplasm, blood and circulation, absorption, excretion; Movement; Sensation and Reaction; Behavior, Instinctive and Intelligent; Reproduction and Heredity; Growth and Transformation; Family Life; Social Life; Adaptations to Haunts and Seasons; Classification; Evolution; Insects and Other Organisms; Insects and Mankind. The work, tho thoroly accurate and scientific in its treatment, largely avoids strictly technical terms. One who has had no entomological training whatsoever should find the book entirely clear. It is a decidedly readable and worth while book. It is well illustrated by sixteen plates and eighty-eight text drawings. These, where not original, have been drawn from the entire world, many from American publications, giving to the book a cosmopolitical viewpoint.

"Spraying, Dusting and Fumigation of Plants" by A. Freeman Mason. The first half of the book is a treatment of fungicides and insecticides and is thoroly up-to-date. In the second half of the book the author mostly takes up each family of economic plants and attempts to treat of the chief insect pests and fungous diseases. The space devoted to each crop is necessarily brief. Of interest to Floridians is his chapter on Citrus. This is not strictly up-to-date, aphids especially are not even mentioned. The grower of truck crops in Florida will look in vain for some of his most destructive insects. On the whole, however, this will prove a very valuable reference work.

In "Leaf-Mining Insects" by Needham, Frost and Tothill (The Williams & Wilkins Co., Baltimore) the authors bring together the hitherto scattered literature on this subject. The life history

and biology of the insects are treated fully. This makes not only an invaluable reference book but a very readable book as well. Very complete lists of insects, bibliography, and indices add to the value of the book.

THE MEXICAN CHICKEN BUG IN FLORIDA

By W. S. BLATCHLEY, Dunedin, Florida.

On July 20, 1928, I received from Prof. J. R. Watson a half dozen specimens of a bug belonging to the bed-bug family, Cimicidae, which had been taken near Lakeland, Fla. Prof. Watson stated that a number of years ago he had taken the same bug near Tavares, Lake County, and that "it is probably widely distributed in Florida but not common anywhere." He added: "I take it to be the chicken bed-bug, but am surprised not to find it in your book," (Heteroptera of Eastern North America).

Prof. Watson was correct in his surmised common name of the insect. I found it to be No. 839 of the Van Duzee Catalogue, viz., *Haematosiphon inodorus* (Duges), commonly known as the "Coruco" or Mexican chicken bug. As Van Duzee gives its distribution as "New Mexico, Texas, (Mexico)" and as I had no knowledge of the Tavares, Fla., record, I did not include it in the Heteroptera, which covers only the territory east of the Mississippi River.

The insect was originally described[1] in 1892 as *Acanthia inodora* by Dr. Alfredo Duges, of Guanajuata, Mexico. Champion, in 1900,[2] founded for it the genus *Haematosiphon*. C. H. Tyler Townsend states[3] that in southern New Mexico "it is an unmitigated pest of poultry, swarming in great numbers in the hen-houses, infesting the inmates and roosts, and covering the eggs with the black specks of its excrement. By day the Corucos stick to the hen-houses and roosts, awaiting the return of the hens at night. It also spreads from the hen roosts to dwelling houses, where it proves to be more formidable than the common bed-bug. About the only way to keep poultry uninfested is to keep them entirely out of doors and not to house them at all."

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[1] La Naturaleza, (2) Vol. II, 1892, p. 169, pl. VIII, figs. 1—7.
[2] Biol. Centr. Amer., Heteroptera, II, p. 337.
[3] Proc. Ent. Soc. Wash., III, 1894, p. 40.

Prof. Geo. M. List, of Ft. Collins, Colorado, our present day authority on the North American species of the family Cimicidae, informs me that he has records of *H. inodorus* from central Kansas, but that it has not before been recorded from east of the Mississippi River.

From the common bed-bug, *Cimex lectularius* Linn., the chicken bug may be known by its smaller size (2.5—3 mm.), more rotund form, more finely punctate upper surface and especially by the much less deeply excavated front margin of pronotum, the lateral angles of which do not project forward on the sides of the head as in *C. lectularius*. The very short pubescence of upper surface and long third antennal joint, which is double the length of joint 4, distinguish it from our members of the genus *Oeciacus*, which prey upon swallows.

THE SCARABAEIDAE OF FLORIDA

By W. S. BLATCHLEY

Dunedin, Florida

(Continued from page 30)

Genus XX. GEOTRUPES Latreille

Medium sized, broad, oval convex black, bluish or metallic green beetles possessing the characters of the subfamily but having the club of antennae lamellate as in most other Scarabaeidae. In the first five species listed the elytra are free and inner wings present. They feed mainly on cow dung and decaying fungi.

*67. (13292). **G. chalybeus** Lec., 1878, 402.

Length 20-22 mm. Blackish-blue, very shining with metallic gloss; elytra with rows of fine punctures, the sutural striae alone impressed; middle and hind tibiae without external apical ridge.

Described from Tampa. Gainesville and Lake City (Ag. Coll.); Enterprise (Dietz). Apparently a rare species in the State.

68. (13293). **G. blackburni** (Fab.).

Length 13-16 mm. Black, feebly bronzed; thorax in this species and the next with basal margin entire; elytra deeply striate, the striae finely punctured; scutellum equilateral; spur of front tibiae of male only half the length of outer apical tooth of tibiae.

Tallahassee (Sz. Ms.). Lake City, Feb. 11 (Ag. Coll.).

*69. (13294). **G. egeriei** Germ.

Length 16-17 mm. Head black, elytra dark green, shining, antennal club yellow; scutellum distinctly wider than long; elytral striae coarsely

crenately punctate; front tibiae of male with spur slender, almost as long as outer apical tooth.

St. Augustine (Ham.). Dunedin, October 21, December 10, in decaying fleshy fungi (Bl.).

70. (13298). **G. semiopacus** Jekel.

Length 14-16 mm. Black, feebly shining; head without tubercles; basal margin of thorax in great part wanting; elytra striate, striae not punctate, intervals flat, smooth.

Lake City (Ag. Coll.). No definite published record from the State.

71. (13299). **G. splendidus** (Fabr.).

Length 13-17 mm. Brilliant metallic green to dark bronze; head with median tubercle; scutellum equilateral; elytra deeply striate, finely crenately punctate; male in this and *semiopacus* with middle tarsi short and thick.

Enterprise (Sz.); Gainesville (Ag. Coll.).

72. (13300). **G. lethroides** West.

Length 14.5-17 mm. Blackish-bronzed, opaque; thorax dissimilar in the sexes; elytra connate, not striate or punctate, densely granulate, inner wings absent; metasternum very short. Head of male tuberculate or with a horn.

St. Augustine (Ham.); Enterprise (Dietz). The *G. retusus* Horn is a synonym.

Subfamily ACANTHOCERINAE

Small oval convex shining beetles having the mandibles corneous, prominent; antennae 10-jointed, club 3-jointed; scutellum very large; front coxae conical, prominent; pygidium concealed; ventral segments five, free; side pieces of mesosternum reaching the oblique middle coxae. They live in the debris under loose bark or in rotten wood, sometimes in carrion. Only two genera represent the subfamily in the United States.

XXI. CLOEOTUS Germar

Body partly contractile; middle and hind tibiae thick. Other characters as above given.

73. (13320). **C. aphodioides** (Ill.).

Length 4-4.5 mm. Blackish or purplish-bronzed, polished; elytra with side margins entire, disk with rows of long, deeply impressed close-set punctures.

Enterprise, rare (Sz.); Crescent City and Biscayne Bay (Sz. Ms.); Citra (Dietz).

*74. (13321). **C. globosus** (Say).

Length 4-5 mm. Resembles the preceding; somewhat darker, the elytra with side margins finely serrate and punctures more distant one from

another. Both species, when disturbed, fold themselves into a ball and feign death.

Enterprise, rare (Sz.); Crescent City (Sz. Ms.); Lake Worth (Ham.); Gainesville (Ag. Coll.). Dunedin, March 19-April 9, taken by beating dead limbs in hammock; Jan. 20, at porch light (Bl.).

Genus XXII. ACANTHOCERUS MacLeay

Differs from *Cloeotus* in having the body perfectly contractile and middle and hind tibiae compressed.

75. (13322). **A. æneus** MacL.

"Bronzed; antennae and under surface ferruginous; front of head punctate, occiput and thorax glabrous; elytra punctate-striate, the punctures indistinct." (MacLeay).

Enterprise "rare, beaten from dead vines." (Sz.); Haw Creek (Sz. Ms.).

(To be continued)

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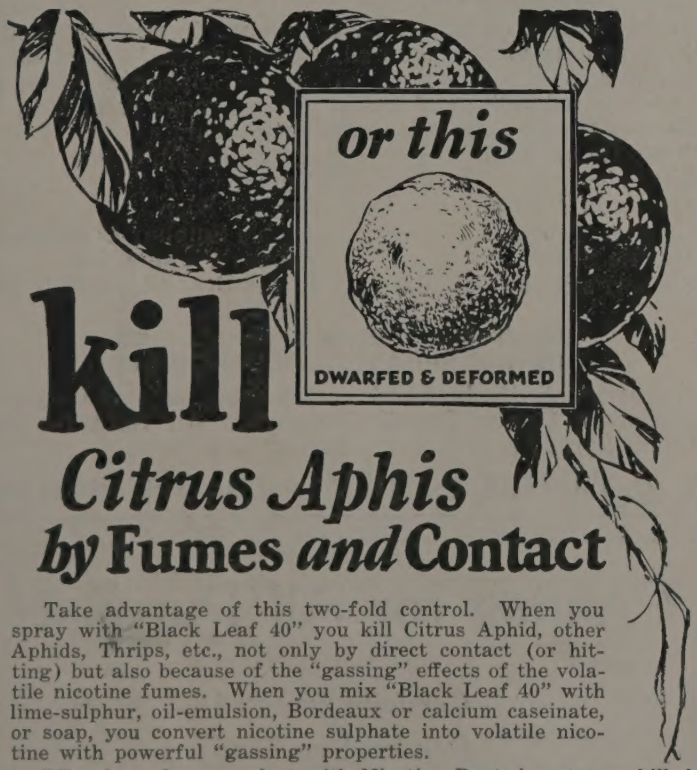

kill *Citrus Aphis* *by* Fumes *and* Contact

Take advantage of this two-fold control. When you spray with "Black Leaf 40" you kill Citrus Aphid, other Aphids, Thrips, etc., not only by direct contact (or hitting) but also because of the "gassing" effects of the volatile nicotine fumes. When you mix "Black Leaf 40" with lime-sulphur, oil-emulsion, Bordeaux or calcium caseinate, or soap, you convert nicotine sulphate into volatile nicotine with powerful "gassing" properties.

Likewise, when you dust with Nicotine Dust, insects are killed by actual contact of the dust with their bodies and also by the powerful nicotine gas.

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TOBACCO BY-PRODUCTS & CHEMICAL CORP.

(Incorporated)

LOUISVILLE, KENTUCKY

Kills Aphis

"Black Leaf 40"

40% Nicotine

Now is the time to spray trees affected with rust mite, scab or melanose. We handle the

DRY LIME SULPHUR

It saves freight on water and expense of handling. Shipped in air-tight packages with removable top. Will keep indefinitely if top is replaced after using. Dissolves readily in any water. Add Dry Lime Sulphur to water and stir. Five pounds to one hundred gallons water for rust mite, equivalent to two gallons 33° Lime Sulphur Solution to one hundred gallons of water. Prices range from 10½ to 25c per pound according to quantity order.

Arsenate of Lead
Bluestone
Bordeaux Mixture
Genuine Protexol
Caustic Soda
Schnarr's Spray Formula
Carbolic Acid, Crude
Copperas
Fish Oil Soap
Soluble Sulphur Compound
Sulphur Flowers, etc.
Target Brand White Fly Destroyer.

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